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November 30th, 1992

Ed Abbasi, Permit Manager
Washington State Department of Ecology
3190 160th Avenue S.E.
Bellevue, Washington 98008-5442

Dear Mr. Abbasi:

Enclosed is Metro's Annual Combined Sewer Overflow (CSO) Report prepared in accordance with the requirements established within NPDES Permit No. WA-002918-1 (M), S11.C.2 and WAC 173-245-090.

The report contains:

- * An overview of Metro's CSO Control Program
- * The status of the CSO control program
- * 1991-1992 overflow volume and frequency summaries
- * An overview of Metro's CSO Monitoring Program
- * Discharge monitoring data for 1990-1992

Total combined sewer overflow volumes and events were significantly below baseline levels for the 1991/1992 reporting year. While some of this decrease is a result of below average rainfall, completion of Phase II of the Lander/Bayview project along with completion of the Parallel Fort Lawton Tunnel have contributed somewhat to these reductions. CATAD will be turned on shortly. Once operating, the improved CATAD system will contribute up to 200 MGs a year in reduction benefits. Design of the Kingdome Industrial Area Storage and Separation and predesign of the Michigan Street Separation were accelerated. Metro fully expects that it will attain the goal of 75% CSO reduction by the year 2005.

Please call me at 684-1236 or Laura Wharton at 684-1238 if you have any questions.

Sincerely,

A handwritten signature in dark ink, appearing to read "Gunars K. Sreibers", is written over the typed name.

for Gunars K. Sreibers
Supervisor, Facilities Planning Section

Enclosure

cc: Laura Wharton, Metro
Conrade Welch, Metro
Karen Huber, Metro

ANNUAL CSO REPORT

1991/1992

METRO

NOVEMBER 1992

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CHAPTER 1

CSO CONTROL PROGRAM IMPLEMENTATION

COMBINED SEWER OVERFLOW CONTROL PROGRAM IMPLEMENTATION

Introduction

Metro has been working on CSO abatement projects since the 1960s. Metro's CSO planning was first formalized in 1979 with the development of the 1979 CSO Control Plan under which weirs were adjusted, CATAD operations modified and Lake Washington pumping stations upgraded. One result was the successful control of all CSOs into Lake Washington. In 1985, the earlier plan became a component of a larger Plan for Secondary Treatment Facilities And Combined Sewer Overflow Control. In response to concerns from the City of Seattle, the 1985 Plan was expanded in 1986. Before this plan was approved, new regulations were promulgated by the Department of Ecology. Metro's response was the 1988 CSO Control Plan which addressed alternatives for remaining sites in the Ship Canal, Duwamish River and Elliott Bay. The Plan identified ten separate CSO Control Projects and an implementation schedule to achieve a 75 percent CSO volume reduction by the year 2005.

CSO Annual Reports are submitted to the Washington State Department of Ecology to meet Ecology's regulations. The reports provide control program status, overflow volume summary information, monitoring program data, frequency of overflow event information and summaries of data analyses.

<u>Program Schedule</u>	<u>Design Initiation</u>	<u>On-Line</u>
Alki Transfer/CSO Treatment Facility	1989	1996
Carkeek Transfer/CSO Treatment Facility	1988	1994
CATAD Modifications	1987	1992
Fort Lawton Parallel Tunnel	1987	1991
Hanford/Bayview/Lander	1986	1992
University Regulator	1986	1993
Kingdome Storage & Separation	1991	2006
Denny Way Separation	1993	1999
Diagonal Separation	1995	1999
Michigan Separation	1991	2003

Status of Initiated CSO Control Projects

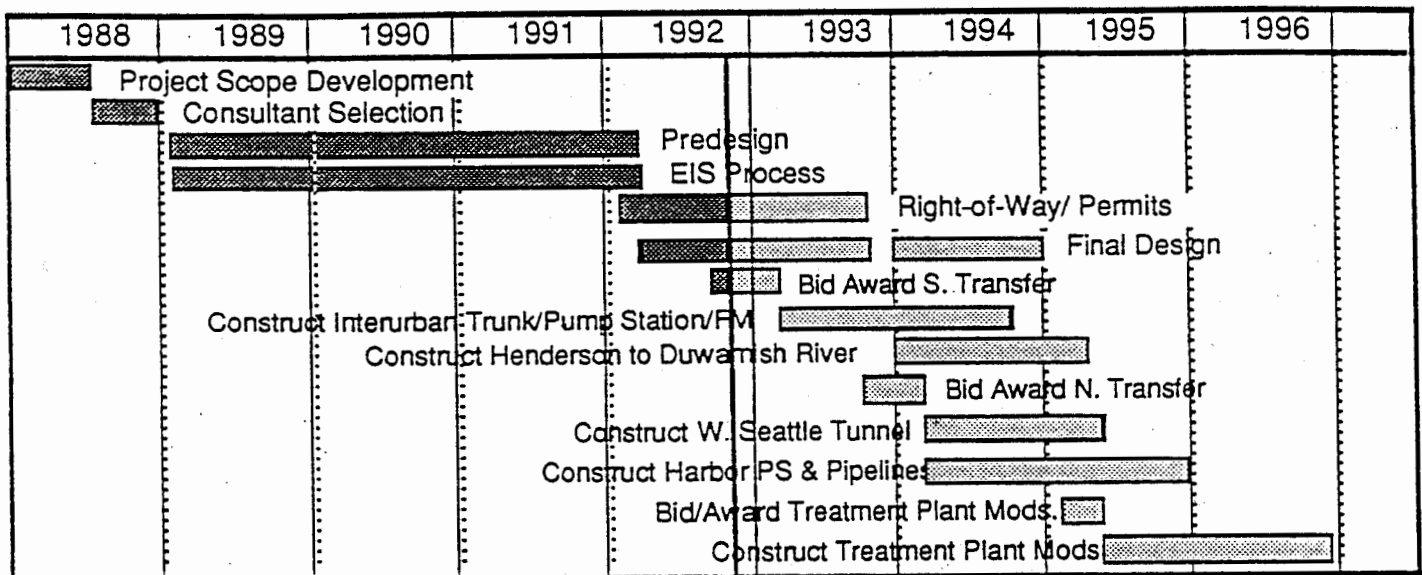
Alki Transfer/CSO Treatment Facility

Scope

The Alki project is designed to transfer base flows (2.25 x Average Wet Weather Flows (AWWFs)) from the Alki Drainage Basin to the West Point Plant for secondary treatment. Flows above this level, to a maximum of 74 million gallons per day (MGD), will receive primary treatment and disinfection at Alki. The existing facility will be modified to permit intermittent discharges and flows will be discharged from the existing outfall. Specific permit conditions for operation of the Alki facility have been negotiated with Ecology. Full utilization of this plant is contingent on West Point being on-line in 1995.

Status

The following schedule outlines 1988-1996 project tasks:



Predesign was completed in January of this year and the Final Environmental Impact Statement was issued in April. Final design of the Interurban project is complete. Final design of the remainder of the Southern Transfer and the Transfer to West Point will be completed late in 1993. Design of the treatment plant modifications will start in January 1994 and are expected to be completed in September 1994. The first contract, Interurban, will be advertised during the first quarter of 1993. Construction of the remaining transfer projects will occur between 1994 and 1995.

The treatment plant modifications will be implemented between 1995 and 1996.

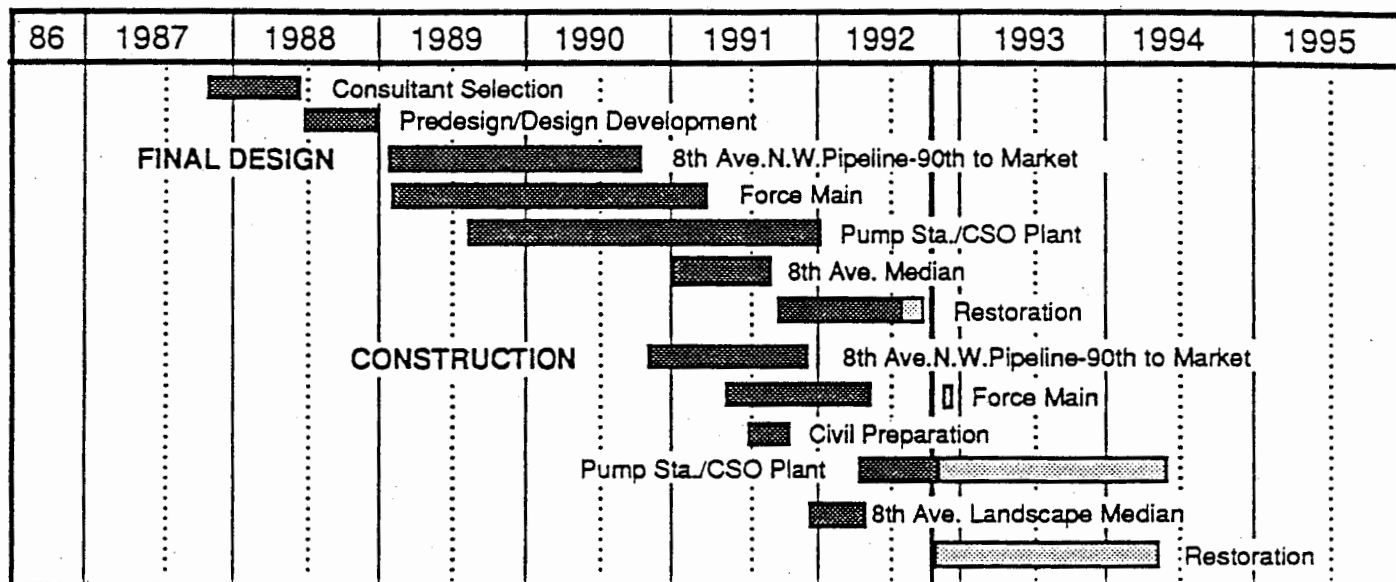
Carkeek Transfer/CSO Treatment Facility

Scope

The Carkeek project is designed to transfer base flows (2.25 x AWWF) from the Carkeek drainage basin to the West Point Plant for secondary treatment. Flows above this level, to a maximum of 20 MGD, will receive primary treatment and disinfection at the existing Carkeek Treatment Plant and be discharged through the existing outfall. The existing facility will undergo minor modifications to allow treatment of peak storm related flows up to 20 MGD. Specific permit conditions for operation of the Carkeek facility have been negotiated with Ecology.

Status

The following schedule depicts 1987-1994 project tasks:



Final Design of all elements will be completed by the end of 1992. Construction of the 8th Ave. N.W. pipeline was completed in November of 1991. Construction of the pump station and modifications to the existing CSO plant started in May of this year and are expected to be completed by June 1994. Full utilization of this project is contingent on West Point being on-line in 1995.

CATAD Modifications

Scope

The Computer Augmented Treatment and Disposal System (CATAD) controls the West Division Collection System. Modifications of the CATAD system are designed to improve system efficiency by increasing utilization of storage capacity in existing sewers.

The previous computer control system utilized 17 to 28 million gallons (MGs) or 28 to 47 percent of the storage within the system's estimated 60 MG capacity. Initial estimates projected that improvements to the system would reduce CSO volumes by 150 million gallons per year. Off-line testing has revealed that a reduction of more than 200 million gallons a year can be achieved as a result of system improvements.

Status

Project Elements:

- * Hydraulic and hydrological models were completed in 1987.
- * Flow forecast programs were completed in 1988.
- * Predictive (Adaptive) Control development was completed in 1991.
- * Predictive Control testing and tuning began in October 1991 and will be completed in December of 1992.
- * Five new depth sensors were purchased and installed at selected sites in 1991 to increase collection system flow information. Sensor installation was completed in June of 1991.
- * Five new rain gauges were installed in 1991 to more effectively measure rainfall in the West Point Service Area. These were activated in September of 1991.
- * Facilities Planning System (FPS) was completed and documented in 1991. The FPS package allows Metro staff to utilize models and programs developed for the Predictive Control System.
- * The system is expected to be fully operational in December of 1992.

Fort Lawton Parallel Tunnel

Scope

The West Point Secondary Treatment Plant *will have* a peak capacity of 440 MGD. The new parallel tunnel will store and transport 82 MGD of combined sanitary and stormwater flows (over the secondary base flow capacity of 358 MGD) to West Point. The tunnel, activated in November of 1991, will provide CSO reduction at the Ballard Regulator and Third Avenue West Weir. *not secondary treatment ?*

The following schedule depicts 1987-1991 project tasks:

Construction was completed in the summer of 1991.

Scope

Hanford

Bayview/Lander

6

the project requires installation of a new stormwater collection system in the basin that will be operated and maintained by the City of Seattle. The Bayview Tunnel will be used to divert flows from the Hanford Basin to the 96-inch Lander Sanitary Trunk Line. Overflows will be reduced at Lander as a result of the project. The components of Phases I and II are as follows:

Phase I:

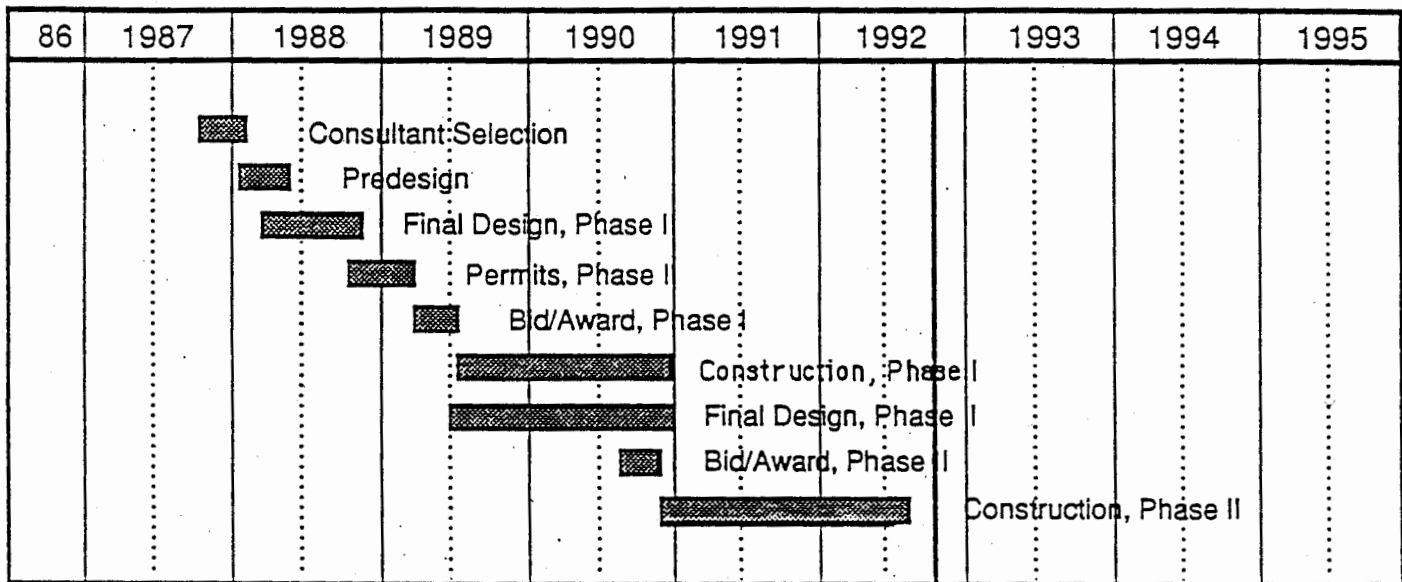
- * 96-inch Lander Sanitary Trunk
- * New Lander Regulator Station
- * Elliott Bay Interceptor Connection
- * Bayview Diversion Structure
- * New stormwater collection system from existing 84-inch Lander Trunk to the limits of the Lander Street right-of-way.
- * Connection of existing combined collection system to new 96-inch sanitary trunk through drop manhole structures.

Phase II:

- * New stormwater collection pipeline in Lander Basin
- * Connection of existing street drainage and parking lots to new stormwater collection pipeline within right-of-way limits.

Status

The following schedule depicts 1987-1992 project tasks:



Consultant selection, predesign and final design of Phase I occurred in 1988. Phase I construction began on schedule and was completed in October of 1990. Phase II construction started in November of 1990 and was completed in January of 1992. Project closeout will be completed during the first quarter of 1993.

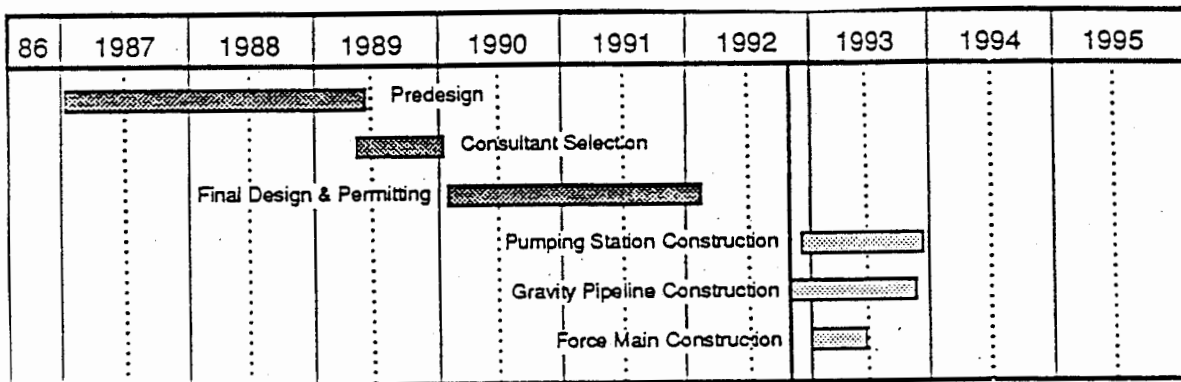
University Regulator Sewer Separation

Scope

As a result of the University Regulator Project, storm runoff from the Densmore Drain, Interstate-5, and outflow from Green Lake will be diverted from Metro's North Interceptor sanitary sewer system to a new storm drain. CSOs into Portage Bay will be reduced by an estimated 111 MGS annually.

Status

The following schedule depicts 1987-1993 project tasks.



Metro completed final 90% plans in October of 1991. Restoration designs were reviewed with the Department of Natural Resources, Seattle Department of Engineering and the community in September of 1991. Final design and permitting were completed in January 1992. Construction of the gravity pipeline and pumping station will begin in November 1992 and continue through the last quarter of 1993. Construction of the force main will start in January 1993 and continue through June 1993.

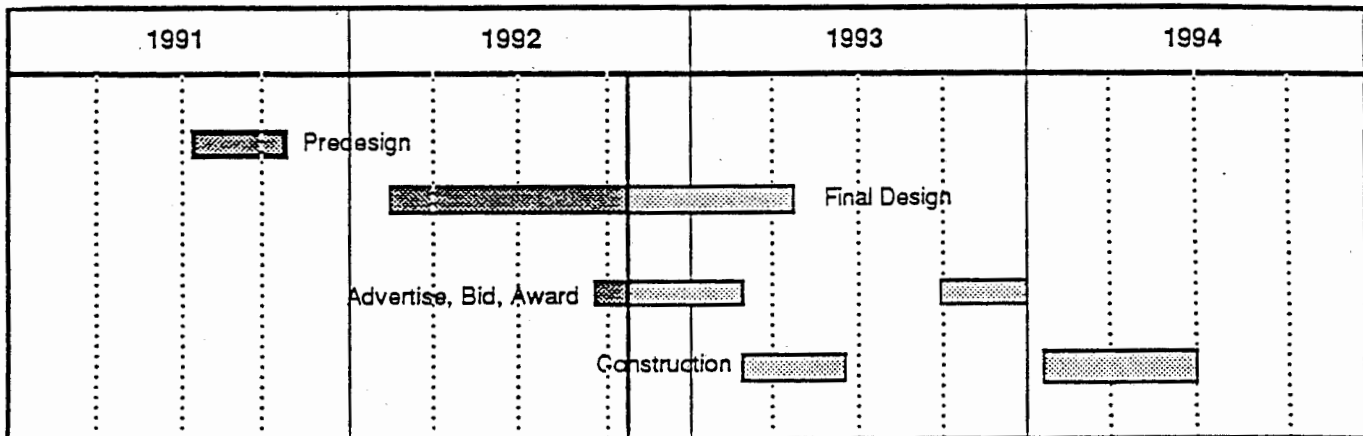
Kingdome/Industrial Area Storage & Separation

Scope

This project will reduce overflows at the Connecticut regulator by providing about 750,000 gallons of in-line storage. A new eight foot diameter trunk sewer and regulator will be constructed. These will channel flows to the Elliott Bay Interceptor.

Status

The following schedule depicts 1991-1993 project tasks.



The scope of the project has been changed since issuance of the 1988 CSO Control Plan. The project was originally designed as partial separation and was scheduled to be undertaken in 2003. Design of the project was moved forward to coordinate Metro's activities with city of Seattle street improvements in the project area. In addition, during design, the focus of the project changed from partial separation only, to a combination storage and separation. Design revealed that the only element of the project affected by Seattle's street improvements was the 8 foot diameter in-line storage trunk. This was the only project element Metro accelerated.

Final design of the storage trunk will be completed in December of 1992. Permitting and bidding will be completed by March of 1993. Construction is scheduled from March 1993 to August 1994. Because of budget problems, scheduled completion has been extended through August 1994.

*not entire project construction
now*

Additional CSO Abatement Projects

Predesign, on the Michigan Separation Project was accelerated to coordinate Metro's activities with the City of Seattle's design of the First Avenue South Bridge. Design of the Michigan Street project started in July 1991 and was completed in March 1992.

Remaining projects include the Denny Way and Diagonal separation projects. To date no project elements appear to conflict with Seattle's proposed bridge improvements. Consequently Metro will wait until 1994/1995 to begin final design.

Related Work

Denny Way Sediment Capping Project

Scope

A sediment capping project was conducted offshore of the Denny Way CSO as an experimental demonstration project to evaluate the benefits of capping as a means of improving sediment quality in Elliott Bay. A total of thirteen barge loads of clean dredged sand were delivered and spread over a rectangular capping site (200 ft x 600 ft) in a cooperative effort between the City of Seattle, U.S. Army Corps of Engineers (COE) and Metro. In support of the capping operation, Metro conducted pre-dredge testing of capping sediments; dissolved oxygen testing during cap placement; and measured at six diver-installed rods and plates to determine foundation settlement and cap thickness. Metro is currently conducting a five-year post-capping monitoring program that includes surface grab sediment sampling to measure cap chemistry for recontamination and benthic taxonomy for recolonization evaluation; video camera surveying to view overall bottom condition; coring with sediment chemical testing to determine cap effectiveness in isolating chemicals; and preparing reports during the monitoring period.

Status

The capping was completed in March 1990. The monitoring program runs from 1990 to 1995 with monitoring reports scheduled to be completed in 1990, 1991, 1992 and 1994. A 5-year project review will be conducted in 1995.

Michigan Source Control

A source control study was recently conducted in the Michigan street basin involving the following elements: baseline sampling of stormwater discharges, surveys, inspections, educational outreach, development of compliance and enforcement schedules. The final report, expected in the first quarter of 1993, will make recommendations for furthering source control in the basin.

Lander Post Project Monitoring

A plan is being developed to monitor and inspect businesses in the Lander Street Basin for a five to ten year period after completion of the University Regulator project. This will help to determine the effectiveness of source control.

CHAPTER TWO

1991/1992 CSO VOLUME SUMMARY

1991/1992 CSO Volume Summary

Introduction

The volume and frequency of CSOs at 18 regulator stations in the West Point System are monitored by Metro's CATAD System. Metro's West Point System is divided into the Northern Service Area (NSA) and the Southern Service Area (SSA). Overflow reports are generated daily, evaluated by staff and archived for future use. Metro deploys portable flow meters at two stations not currently monitored by CATAD: overflow weirs at Third Avenue West and 11th Avenue N.W. (Ballard Regulator Station).

Baseline Conditions

The volume and frequency of overflows will change as the amount of rainfall deviates from the average. In order to estimate the variability of CSO volume and frequency, 42 years of hourly rainfall data were entered into a model developed to predict CSOs from the Metro System. The model was used to calculate the annual CSO volume that would have occurred in the collection system as it existed in 1981-1983 for the rainfall for each of the years 1943 through 1984. Ecology proposed 1981-1983 CSO conditions as a baseline for judging CSO control. It was found that the 1981-1983 CSO volume and frequency would be exceeded (even if the collection system and all other aspects of the regulators, CATAD, etc., remained unchanged) about once every five years because of year-to-year variations in rainfall. Thus, the baseline condition for 1981-1983 represents the physical characteristics of the collection and CATAD system during this time period, rather than a not-to-be exceeded CSO volume.

While the establishment of baseline conditions identifies average annual volume and frequencies of discharge, year-to-year comparisons to baseline conditions can be misleading. Yearly annual rainfall cannot indicate year-to-year variations in CSO volumes for individual basins as rainfall can be extremely variable in the Seattle area. Individual storm events can disproportionately influence total overflow volume since peak storm events may contribute significant rainfall accumulations in relatively short periods of time resulting in large overflow volumes while storms of low intensity and long duration may be equated with overflows of a lesser volume. Rainfall should ideally be compared by basin to derive an accurate understanding of system response.

The relationship between CSO volume and rainfall is approximated by the following formulas:

Baseline NSA

$$\text{CSO Volume (in MG)} = (19.3 \times 36 \text{ inches}) - 190 = 458 \text{ MG}$$

Baseline SSA

$$\text{CSO Volume (in MG)} = (66.7 \times 36 \text{ inches}) - 460 = 1941 \text{ MG}$$

Baseline Total

$$\text{Baseline NSA} + \text{Baseline SSA} = 2399 \text{ MG}$$

CSO Volume Comparison To Baseline Conditions

Rainfall levels for the 1991/1992 reporting period were significantly below the norm for the Seattle Area. Approximately 23¹ inches of rain (Appendix A) were recorded compared with a yearly average of 36 inches. This, in addition to the completion of several CSO reduction projects, contributed to a reduction to baseline levels for both CSO volumes and events. A total overflow volume of 892 MG was recorded compared with a baseline of 2399 MG (see Table 1). Overflows in the SSA totalled 783 MG, 1158 MG under baseline conditions. Overflows in the NSA totalled 110 MG, 348 MG under baseline conditions. These figures are shown in Table 1. *from*

Table 1

Baseline/Service Area Comparison

<u>Service Area</u>	<u>1988 CSO Plan</u>	<u>1991/1992</u>	
NSA	458 MG	110 MG	253 MG by equation
SSA	1941 MG	783 MG	1074 by equation
TOTAL	2399 MG	892 MG	

One storm event alone accounted for approximately half of the year's total overflow volume. This event (see Table 2) contributed 423 MG out of the 892 MG total. During this event approximately 3.7 inches of rain was recorded by the city of Seattle's rain gauges.

¹This is based on the use of unedited data from the city of Seattle's gauges. Edited data accounts for nonfunctioning gauges. If edited data were used, it is highly likely that higher rainfall levels would be shown for the recording period.

Table 2

<u>Storm Date</u>	<u>Associated Overflow Volume</u>
Jan 27-Feb 3	423 MG

SSA Overflow Volume

1991/1992 overflow volumes in the SSA were 1158 MG under baseline conditions. The largest volumes were experienced by Denny Way, Brandon and Hanford #2 respectively (see Table 3). Large volume reductions occurred at Hanford #2, 8th Avenue and Norfolk.

Denny Way overflowed 417 MG compared with a baseline of 370 MG. Erroneously elevated level sensor readings caused regulator gates at Denny Way Local and Lake Union to be closed for several hours longer than normal during the large storm that occurred between January 27th and February 3rd. This contributed to the above baseline levels experienced at Denny Way.

Brandon experienced overflow volumes of 135 MG compared with a baseline of 35 MG. This deviation from baseline is currently under investigation.

Volumes at Norfolk decreased to 8 MG (compared with a baseline of 4 Mg). This represents a significant fluctuation from last year's volume of 169 MG. Staff are currently investigating possible reasons for this fluctuation.

Hanford 2 had 65 MG of overflows compared with a baseline of 680 MG. This is partially attributable to completion of Phase II of the Hanford/Bayview Project.

Michigan had 52 MG of overflows compared with a baseline of 250 MG. This represents a 15 MG increase over 1990/1991 volumes despite significantly lower than normal rainfall for 1991/1992. An investigation (CSO Plan Five-Year Update) determined that the previous year's flows only accounted for volumes that went over the weir. Overflows from the outfall gate were not recorded. This problem was corrected in December of 1991.

No overflows were calculated at the new Lander Station (Lander 2). The interceptor bubbler tube was broken. The bubbler, which is three feet below actual flow levels, is being repaired.

The trunk bubbler has been plugged by sediment + measures are being taken to correct the problem
The Duwamish Pump Station experienced 0 overflow volumes compared with a baseline of 130 MG. There is no level sensor near the area of potential overflows. Overflow recordings are based on the wetwell levels at the pump station. Wet well levels have not risen above the level of the overflow weir and consequently no overflows have been recorded.

Table 3

1991/1992 Volume Summary by Service Area

STATION	June	July	Aug.	Sep	Oct.	Nov.	Dec.	Jan	Feb.	Mar	April	May	1991/1992 TOTAL	CSO PLAN BASELINE
SSA														
Denny Way	5.79	3.50	41.86	0.00	11.38	60.77	36.92	150.56	52.03	6.16	48.39	0.00	417.36	370.00
King St.	0.00	0.00	2.97	0.00	0.24	1.60	2.44	18.04	8.72	0.81	4.34	0.00	39.16	70.00
Connecticut	0.33	0.16	7.84	0.00	0.34	6.63	4.14	34.90	5.57	3.75	10.65	0.00	74.31	90.00
Hanford #2	0.00	0.00	0.51	0.00	0.00	3.40	3.69	50.35	2.89	0.00	4.49	0.00	65.33	680.00
Lander #1 St.	0.00	0.00	0.00	0.00	0.00	0.32	2.26	0.00	0.00	0.00	0.00	0.00	2.58	215.00
Lander #2 St.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Harbor Ave.	0.44	0.13	1.69	0.00	0.20	1.27	0.60	5.59	1.88	0.60	1.80	0.00	14.20	55.00
Cholan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.47	0.00	0.00	0.47	0.00	1.94	25.00
West Michigan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.02	2.00
Eighth. Ave	0.00	0.00	0.00	0.00	0.00	0.02	0.00	2.08	0.08	0.00	0.10	0.00	2.28	15.00
Brandon St.	0.42	0.21	3.35	0.00	0.57	4.64	4.50	53.63	22.89	2.42	12.63	0.00	105.16	35.00
Michigan St.	0.00	0.00	0.00	0.00	0.00	0.07	0.42	39.02	1.24	1.04	10.47	0.00	52.26	250.00
Norfolk St.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.27	0.00	0.00	0.73	0.00	8.00	4.00
Duamish P.S.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	130.00
TOTAL SSA													782.60	1941.00
NSA														
Ballard	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90.00
Dexter	0.04	0.13	3.85	0.00	0.00	0.00	0.01	0.09	0.02	0.00	0.52	0.00	4.68	12.00
University	0.00	0.30	0.70	0.00	0.00	4.35	0.00	55.19	1.32	0.00	0.42	0.00	62.28	211.00
Montlake	0.00	0.37	0.89	0.00	0.00	0.73	0.77	19.95	2.53	0.71	4.64	0.00	30.59	40.00
Canal St.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.19	0.00	0.55	0.00
Third Ave. W.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.49	0.68	2.15	0.00	0.00	6.32	105.00
Ballard No 1(11th Ave. NW)	0.00	0.62	1.25	0.00	0.00	0.00	0.00	2.14	0.56	0.02	0.59	0.00	5.18	0.00
TOTAL NSA													109.58	458.00
TOTALS (NSA + SSA)													892.18	2399.00

Table 4

1991-1992 FREQUENCY OF EVENTS

Overflow Location	June	July	Aug	Sept.	Oct.	Nov.	Dec.	Jan.	Feb	Mar.	Apr.	May	Total 1991/1992 Station Overflows	CSO PLAN BASELINE	AT 75% Volume Reduction
SSA															
King	0	2	2	0	1	2	4	3	5	3	3	0	25	31	1
Norfolk	0	0	0	0	1	0	0	2	0	0	1	1	5	7	1
Michigan	0	0	0	0	0	2	1	3	1	1	1	0	9	31	1
W/Michigan	0	0	0	0	0	0	0	2	2	0	0	0	4	8	1
Duamish	0	0	0	0	0	0	0	0	0	0	0	0	0	--	1-2
Brandon	2	1	4	0	3	5	3	6	5	4	5	0	38	25	1-2
Chelan	0	0	0	0	0	0	0	1	0	0	1	0	2	16	1-2
Eighth Ave.	0	0	0	0	0	1	0	2	0	0	1	0	4	12	2-5
Denny Way	5	4	4	0	3	4	5	6	6	3	5	0	45	51	2-5
Connecticut	2	1	3	0	1	4	3	4	4	3	3	0	28	25	5-10
Harbor	5	1	4	0	3	9	3	11	7	4	10	0	57	46	10-25
Hanford #2	0	0	1	0	0	1	1	2	1	0	1	0	7	23	10-25
Lander 1	1	0	0	0	0	1	1	0	0	0	0	0	3	19	10-25
Lander 2	0	0	0	0	0	0	0	0	0	0	0	0	0		10-19
NSA													227		
Canal Street	0	0	0	0	0	0	0	1	1	0	1	0	3	--	<1
Ballard	0	0	0	0	0	0	0	0	0	0	0	0	0	13	1-2
Ballard #1(11th Ave.	0	1	1	0	0	0	0	6	3	2	1	0	14	13	5-10
Dexter	1	1	1	0	0	0	1	1	1	1	2	0	9	4	1-2
University	0	1	1	1	0	2	0	2	1	0	1	0	9	14	5-10
Third Ave. West	0	0	0	0	0	0	0	2	1	2	0	0	5	--	1-2
Montlake	0	1	1	0	0	2	1	2	1	2	1	0	11	16	5-10
SSA													51		
Total # Events	16	13	22	1	12	33	23	56	39	25	37	1	278	381	

*Indicates one event which started in January and continued into February.

NSA Overflow Volume

1991/1992 overflows in the NSA were approximately 348 MG under baseline conditions.

Ballard #1 (5 MG compared with a baseline of 0 MG) and Canal Street (0.55 MG compared with a baseline of 0) had overflow volumes above baseline.

40 All other stations registered overflow volumes below baseline. Ballard (0 MG compared with a baseline of 90), Dexter (5 MG compared with a baseline of 12 MG), Montlake (31 MG compared with a baseline of 105 MG), University (62 MG compared with a baseline of 211 MG) and Third Avenue (6 MG compared with a baseline of 105 MG) all fall in this category.

Ballard registered no overflows because the interceptor bubbler was in the Old Fort Lawton Tunnel that was blocked in November. Because it was blocked flows went through the new tunnel and consequently none were recorded at Ballard. *isolated*

Ball reg gate never closed.
no Ballard #1 and Third Avenue West seem to have experienced CSO reduction as a result of the utilization, since November 1991, of the new Fort Lawton Parallel Tunnel. One consequence of flows through the new tunnel is that the level of the interceptor bubbler has dropped for the Ballard Regulator. This has caused the gates to remain open resulting in some lower overflow volumes than would have occurred otherwise.

1991/1992 Frequency of CSO Events

278 overflow events occurred in 1991-1992 compared to a baseline of 381 (see Table 4). This reduction from baseline appears to be a result of decreased annual rainfall. A relatively large number of short intensity storms occurred during the reporting period. These contributed to a less than proportionate decline in CSO events relative to volumes. Figures 1 to 4 graphically shows the relationship between rainfall, CSO events and volumes.

Frequency of events were higher than baseline at Connecticut (28 compared with a baseline of 25), Harbor Avenue (57 compared with a baseline of 46), Brandon (38 compared with a baseline of 25), Ballard #1 (14 compared with a baseline of 13) and Dexter Avenue (8 compared to a baseline of 4). *P 0?*

Frequency of events were lower than baseline at King Street (25 compared with a baseline of 31, Norfolk (5 compared with a baseline of 7), Ballard (1 compared with a baseline of 13) and West Michigan (4 compared with a baseline of 8). *On table*

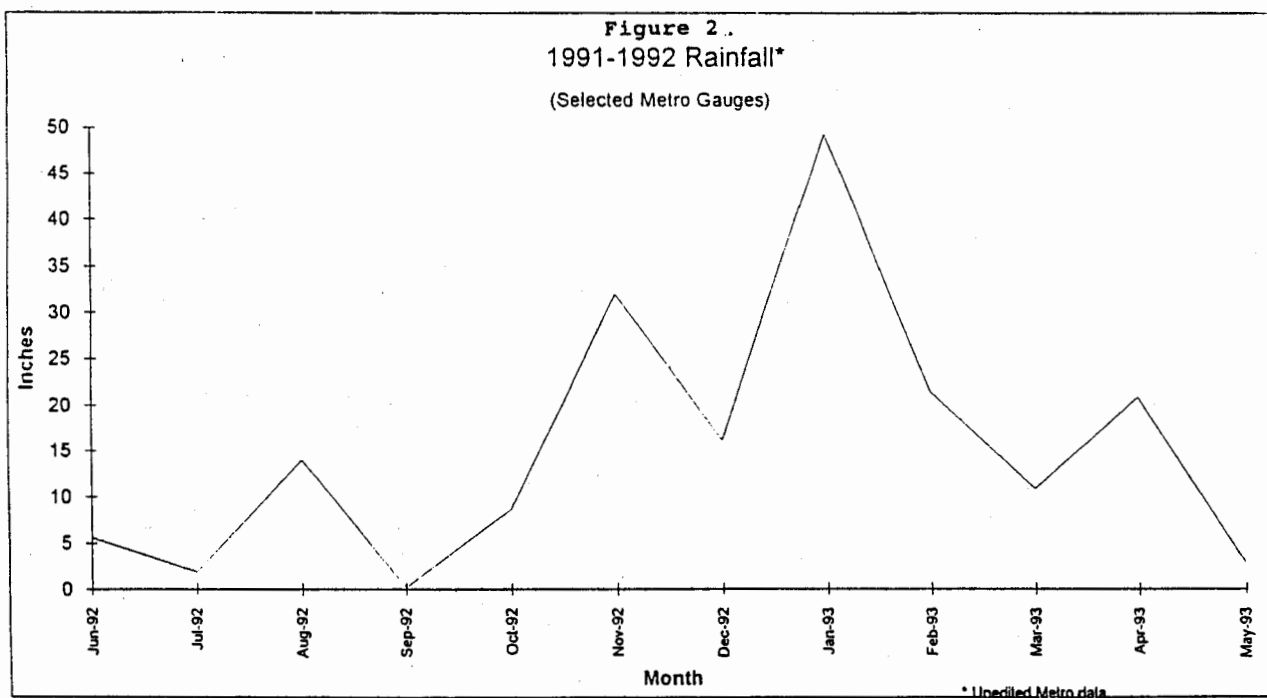
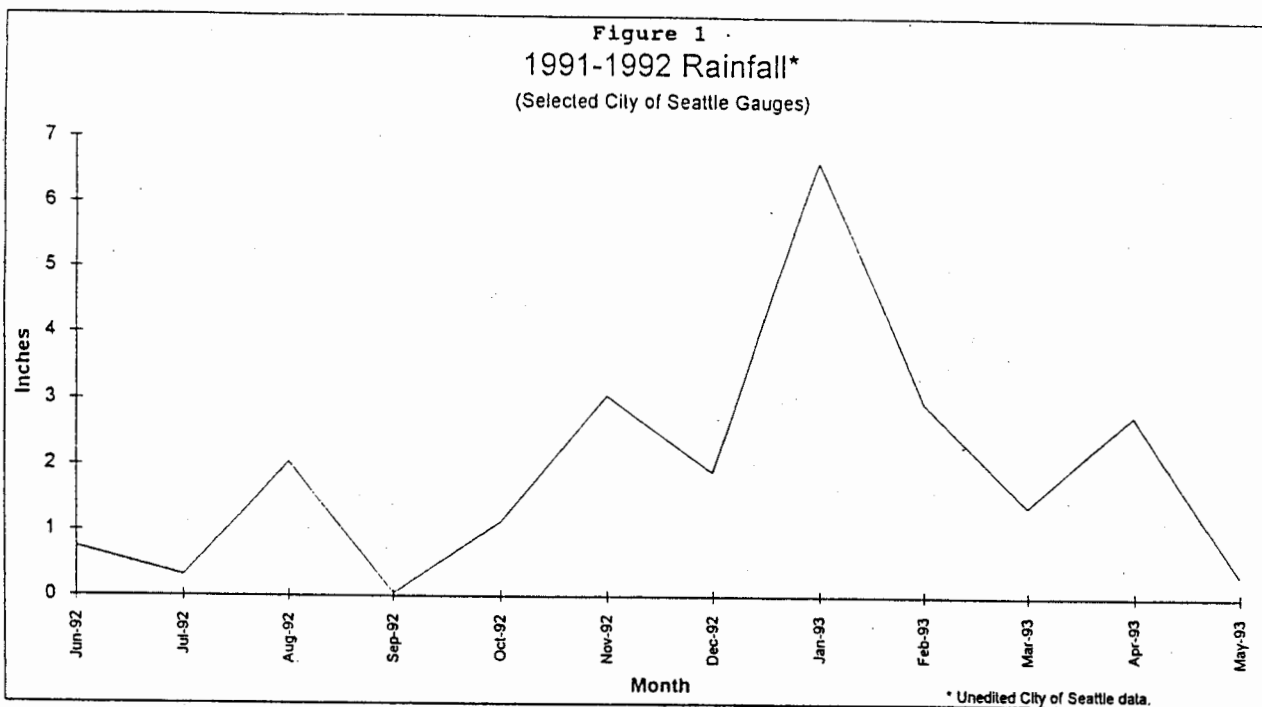


Figure 3
1991-1992 CSO Events

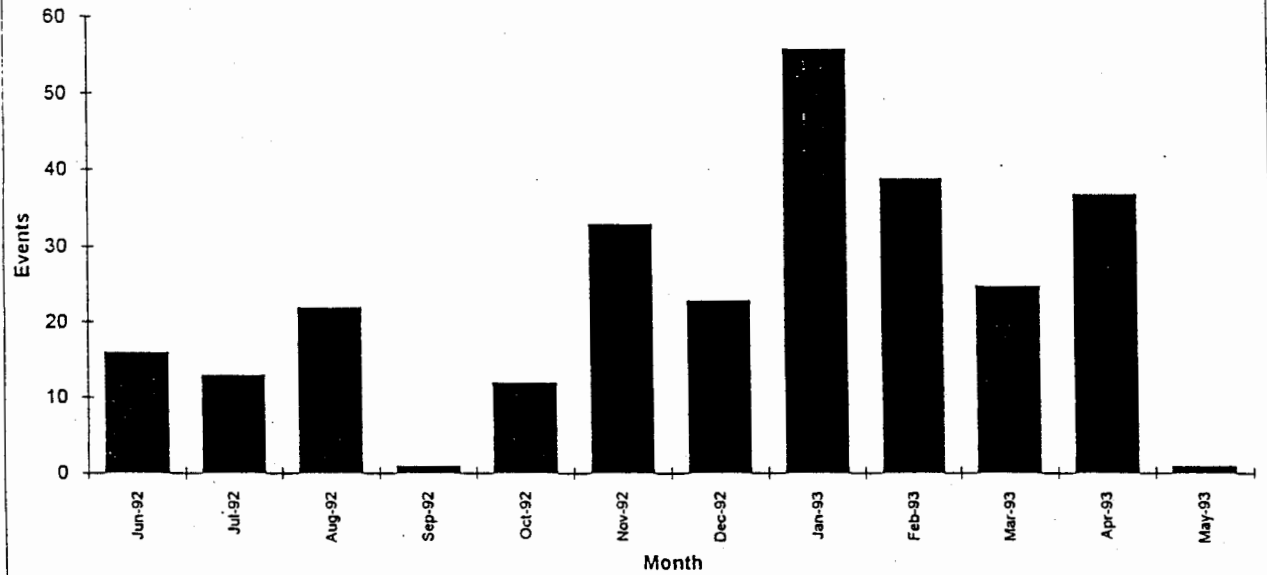
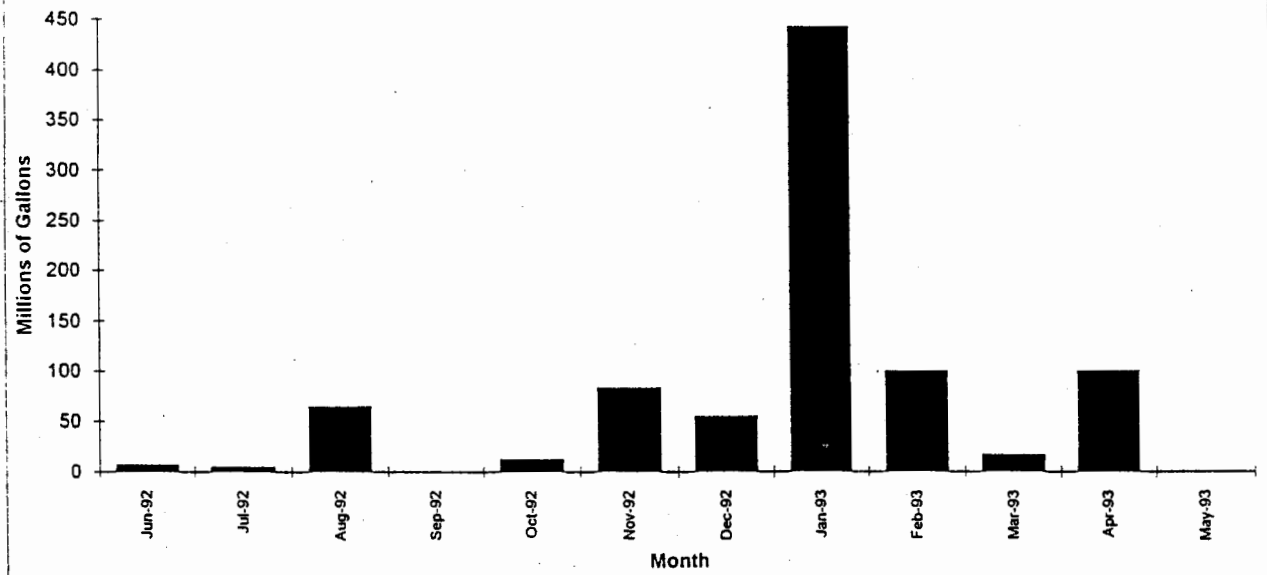


Figure 4.
1991-1992 CSO Volume



Overall, frequency of overflow events decreased significantly from the previous year's levels. Both below average rainfall levels and the realization of benefits of Metro's CSO control programs contributed to this decrease.

CHAPTER THREE

CSO MONITORING PROGRAM

CSO MONITORING PROGRAM

Introduction

Metro's NPDES sampling program calls for discharge sampling of five CSO sites annually through 1992 to meet requirements of WAC 173-245-040 (2) (a) (i) and condition S11.C1 of the West Point Treatment Plant's National Pollutant Discharge Elimination System (NPDES) permit. Appendix B lists stations, sample numbers, dates when samples were taken, and status of each site in the monitoring program. Nine stations were selected for sediment quality sampling and four discharge samples for each CSO under overflow conditions were to be collected to supplement previous monitoring efforts. Sediment sampling requirements were completed in 1990.

1991/1992 Discharge Sampling Data

Scheduled discharge sampling was not completed during the reporting period at either Montlake or S.W. Michigan. The third sampling round was collected at Montlake on 2/21/92 and at S.W. Michigan on 1/28/92. Fourth samples were not possible because of equipment problems and a lack of sufficiently large storm events when sampling equipment was in working condition. Because only three samples were taken no conclusions can be drawn from available data. Table 5 provides available concentrations of metals and conventionals. Samples will be obtained in the 1992/93 wet weather season to complete Metro's regulatory obligations. The 1992/93 Annual CSO Report will contain full data sets of analysis for the Montlake and S.W. Michigan CSOs.

TABLE 5

CSO DISCHARGE DATA

(in ppb or ug/l)

Sample #	9010009	9100609	9200258	9100012	9100613	9200134
Date	12-4-90	4-3-91	2-21-92	1-12-91	4-3-91	1-28-92
Station	Montlake			S.W. Michigan		
NPDES Serial Number	W014			W042		

PRIORITY ORGANIC POLLUTANTS

ACIDS

PHENOL	6.00
2-CHLOROPHENOL	4.00
4-CHLORO-3-METHLY PHENOL	4.00
2,4-DICHLOROPHENOL	2.00
2,4,5-TRICHLOROPHENOL	8.00
2,4,6-TETRACHLOROPHENOL	8.00
2,3,4,6-TETRACHLOROPHENOL	
PENTACHLOROPHENOL	2.00
2-NITROPHENOL	2.00
4-NITROPHENOL	4.00
2,4-DINITROPHENOL	4.00
2,4-DIMETHYLPHENOL	2.00
4,6-DINITRO-2-METHYLPHENOL	4.00
2-METHYLPHENOL(O-CRESOL)	2.00
3-METHYLPHENOL(M-CRESOL)	
4-METHYLPHENOL(P-CRESOL)	2.00
BENZOIC ACID	6.00

BASES

N-NITROSODIMETHYLAMINE	6.00
N-NITROSODI-N-PROPYLAMINE	2.00
N-NITROSODIPHENYLAMINE	2.00
BENZIDINE	48.00
3,3-DICHLOROBENZIDINE	2.00
PYRIDINE	
ANILINE	4.00
1-CHLOROANILINE	4.00
2-NITROANILINE	6.00
3-NITROANILINE	6.00
4-NITROANILINE	6.00

NEUTRALS

9010009	9100609	9200258	9100012	9100613	9200134
12-4-90	4-3-91	2-21-92	1-12-91	4-3-91	1-28-92

1,2-DICHLOROBENZENE	1.00
1,3-DICHLOROBENZENE	1.00
1,4-DICHLOROBENZENE	1.00
1,2,4-TRICHLOROBENZENE	1.00
HEXACHLOROBENZENE	1.00
NITROBENZENE	2.00
HEXACHLOROETHANE	2.00
HEXACHLOROCYCLOPENTADIENE	2.00
HEXACHLOROBUTADIENE	2.00
TRICHLOROBUTADIENE	
TETRACHLOROBUTADIENE	

NEUTRALS

PENTACHLOROBUTADIENE	
BIS(2-CHLOROETHYL) ETHER	1.00
BIS (2-CHLOROISOPROPYL) ETHER	4.00
4-CHLOROPHENYL PHENYL ETHER	1.00
4-BROMOPHENYL PHENYL ETHER	0.60
BIS(2-CHLOROETHOXY) METHANE	2.00
2,4-DINITROTOLUENE	0.80
2,6-DINITROTOLUENE	0.80
NAPHTHALENE	3.00
2-METHYLNAPHTHALENE	3.00
FLUORENE	1.00
ACENAPHTHENE	0.80
ACENAPHYTHYLENE	1.00
ANTHRACENE	1.00
PHENANTHRENE	1.00
FLUROANTHENE	1.20
PYRENE	1.00
CHRYSENE	1.00
BENZO(A) ANTHRACENE	1.00
BENZO(A) PYRENE	2.00
BENZO(B) FLUORANTHENE	3.00
BENZO(K) FLUORANTHENE	3.00
INDENO(1,2,3-C,D) PYRENE	2.00
BIBENZO(A-H) ANTHRACENE	3.00
BENZO(G,H,I) PERYLENE	2.00
-CHORONAPHTHALENE	1.00
DIETHYL PHTHALATE	0.60
DIETHYL PHTHALATE	2.00
DI-N-BUTYL PHTHALATE	2.00
DIETHYL BUTYL PHTHALATE	1.00
DI-OCTYL PHTHALATES	1.00
BIS(2-ETHYLHEXYL) PHTHALATE	
DIETHYL ALCOHOL	2.00
DI BENZOFURAN	2.00
-2,DIPHENYLHYDRAZINE	

9010009	9100609	9200258	9100012	9100613	9200134
12-4-90	4-3-91	2-21-92	1-12-91	4-3-91	1-28-92

ISOPHORONE 2.00

PCBS AND PESTICIDES

TOTAL PCBs

AROCOR 1016	1.00
AROCOR 1221	1.00
AROCOR 1232	1.00
AROCOR 1242	1.00
AROCOR 1248	1.00
AROCOR 1254	1.00
AROCOR 1260	1.00
ALPHA-BHC	0.10
BETA-BHC	0.10
DELTA-BHC	0.10
GAMMA-BHC (LINDANE)	0.10
4,4-DDE	0.10
4,4-DDD	0.10
4,4-DDT	0.10
ALDRIN	0.10
DIELDRIN	0.10
ENDRIN	0.10
ENDRIN ALDEHYDE	0.10
CHLORDANE	0.50
HEPTACHLOR	0.10
HEPTACHLOR EXPOXIDE	0.10
METHOXYCHLOR	
ENDOSULFAN 1	0.10
ENDOSULFAN 11	0.10
ENDOSULFAN SULFATE	0.10
TOXAPHENE	1.00
2,3,7,8-TCDD	

DEMETON
GUTHION
MALATHION
MIREX
PARATHION

VOLATILES

METHYL CHLORIDE	2.00
METHYLENE CHLORIDE	10.00
CHLOROFORM	2.00
CHLOROMETHANE	
CHLOROETHANE	2.00

	9010009	9100609	9200258	9100012	9100613	9200134
	12-4-90	4-3-91	2-21-92	1-12-91	4-3-91	1-28-92
1,1-DICHLOROETHANE	2.00					
1,2-DICHLOROETHANE	2.00					
1,1,1-THICHLOROETHANE	2.00					
1,1,2-TRICHLOROETHANE	2.00					
1,1,1,2-TETRACHLOROETHANE	2.00					
1,1,2,2-TETRACHLOROETHANE						
VINYL CHLORIDE	2.00					
1,1-DICHLOROETHYLENE	2.00					
TRANS-1,2-DICHLOROETHYLENE	2.00					
CIS-1,2-DICHLOROETHYLENE						
TRICHLOROETHYLENE	2.00					
TETRACHLOROETHYLENE	2.00					
1,2-DICHLOROPROPANE	2.00					
CIS-1,3-DICHLOROPROPENE	2.00					
TRANS-1,3-DICHLOROPROPENE	2.00					
METHYL BROMIDE	2.00					
DICHLOROBROMOETHANE	2.00					
CHLORODIBROMOMETHANE	2.00					
BROMOFORM	2.00					
DICHLORODIFLUOROMETHANE						
TRICHLOROFLUROMETHANE	2.00					
ACROLEIN	10.00					
ACRYLONITRILE	10.00					
BENZENE	2.00					
TOLUENE	2.00					
ETHYLBENZENE						
BIS(CHLOROMETHYL) ETHER						
2-CHLOROETHYL VINYL ETHER	2.00					
CARBON DISULFIDE	2.00					
ISOBUTANOL						
ACETONE	10.00					
VINYL ACETATE	10.00					
2-BUTANONE (MEK)	10.00					
4-METHYL-2-PENTANONE (MIBK)	10.00					
2-HEXANONE	10.00					
TOTAL XYLENES	2.00					
STRYENE	2.00					
METALS						
ALUMINIUM	2.300	2.500	6.900	1.500	4.700	2.800
ARSENIC	0.003	0.050	0.050	0.003	0.050	0.050
BERYLLIUM	0.001	0.001	0.001	0.001	0.001	0.001
CADMIUM	0.002	0.002	0.002	0.002	0.002	0.002

9010009	9100609	9200258	9100012	9100613	9200134
12-4-90	4-3-91	2-21-92	1-12-91	4-3-91	1-28-92

CHROMIUM	0.008	0.008	0.020	0.005	0.020	0.006
COPPER	0.027	0.021	0.063	0.021	0.051	0.027
IRON	3.000	2.900	7.500	2.200	5.500	3.100
LEAD	0.050	0.040	0.100	0.030	0.090	0.060
MANGANESE	0.082	0.078	0.018	0.046	0.140	0.110
MERCURY	0.0002	0.002	0.006	0.0002	0.0003	0.0002
NICKEL	0.010	0.010	0.020	0.010	0.020	0.010
SELENIUM	0.003	0.050	0.050	0.003	0.050	0.000
SILVER	0.003	0.003	0.003	0.004	0.003	0.003
ZINC	0.079	0.061	0.190	0.064	0.190	0.130

CONVENTIONALS

BOD	12.000	12.000	24.00	27.000	140.00	25.00
COD	79.000	54.000	110.00	80.000	230.00	140.00
TOTAL-SS	141.329	102.67	259.00	92.000	388.00	126.00
VOLATILE-SS		21.329	80.00		158.00	50.00
OIL-GREASE	5.000	11.000	8.00	20.000	21.000	7.40

NOTE: A BLANK CELL INDICATES THAT A CONSTITUENT WAS NOT DETECTED

APPENDICES

* CITY OF SEATTLE RAINFALL
JUNE 1991 - MAY 1992

STATION	1	2	3	4	7	8	9	11	12	14	15	16	18	20	Totals
MONTH															
June 1991	76	82	66	14	94	111	26	27	83	121	82	84	88	85	0.74
July 1991	35	24	28	35	41	42	55	23	33	20	20	21	28	24	0.31
Aug. 1991	160	181	149	192	232	284	8	127	202	217	188	200	168	181	2.04
Sept. 1991	7	6	3	7	7	12	0	0	3	0	2	0	0	2	0.04
Oct. 1991	120	117	112	123	150	160	32	63	128	143	125	80	109	133	1.14
Nov. 1991	377	405	273	133	422	515	110	301	325	376	214	343	342	174	3.08
Dec. 1991	205	237	116	203	234	203	177	188	213	248	97	215	243	82	1.9
Jan 1992	669	688	599	541	799	792	560	592	661	775	684	621	666	663	6.65
Feb 1992	369	337	273	174	378	378	280	302	331	366	340	283	71	276	2.97
Mar. 1992	151	163	134	15	163	146	144	131	135	145	154	143	156	163	1.39
April 1992	480	278	243	2	250	306	242	272	259	295	340	268	358	315	2.79
May 1992	37	55	42	15	50	34	39	27	47	24	23	23	24	42	0.34
Average 1991/1992															23.39

* Raw data/compiled from City rain gauges.

Appendix A

*

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2.
Group

King
H. D. Dwyer
Dwyer
Lancaster P. S.

***Raw Data Compiled From 8 of Metro's Gauges**

P.S.

APPENDIX B

APPENDIX C

NPDES CSO MONITORING PROGRAM CHECKLIST

DISCHARGE MONITORING

<u>CSO</u>	<u>NPDES#</u>	<u>DATE</u>	<u>SAMPLE#</u>	<u>STATUS OF PROGRAM</u>
MICHIGAN	W039	03/26/88	8800300	PERMIT REQUIREMENTS MET
LANDER	W039	03/26/88	8800301	PERMIT REQUIREMENTS MET
DENNY	W027	03/25/88	8800302	PERMIT REQUIREMENTS MET
E. BALLARD #1	W004	02/22/89	8900177	PERMIT REQUIREMENTS MET
		04/06/88	8800352	
		01/14/88	8800052	
		11/02/88	8802026	
3RD AVE. W.	W008	02/22/89	8900174	PERMIT REQUIREMENTS MET
		01/14/88	8800053	
		03/26/88	8800303	
		11/02/89	8802027	
BALLARD SIPHON	W003	12/02/89	8909776	PERMIT REQUIREMENTS MET
		03/09/90	9000286	
		10/04/90	9000880	
		01/06/90	9000002	
CONNECTICUT	W029	08/22/89	8900832	PERMIT REQUIREMENTS MET
		10/22/89	8909698	
		04/23/90	9000394	
		02/07/90	9000215	
BRANDON ST.	W041	03/14/90	9000298	PERMIT REQUIREMENTS MET
		06/03/90	9000510	
		10/04/90	9000881	
		12/04/90	9010003	
NORFOLK ST.	W044	10/14/90	9000887	PERMIT REQUIREMENTS MET
		06/06/90	9000524	
		04/03/91	9100612	
		12/04/90	9010006	
EIGHTH AVE.	W040			SAMPLING IN 1992/1993
CHELAN AVE.	W036			SAMPLING IN 1992/1993
DEXTER AVE.	W009			SAMPLING IN 1992/1993
MONTLAKE AVENUE	W014	04/03/91	9100609	ADDIT. SAMPLING 1992/1993
		12/04/90	9010009	
		02/21/92	9200258	
S.W.MICHIGAN	W042	01/12/91	9100012	ADDIT. SAMPLING 1992
		04/03/91	9100613	
		01/28/92	9200134	

<u>SEDIMENTS</u>	<u>NPDES#</u>	<u>DATE</u>	<u>SAMPLE #</u>	<u>STATUS OF PROGRAM</u>
BALLARD SIPHON	W003	05/30/89	8900560	PERMIT REQUIREMENTS MET
EAST BALLARD #1	W004	05/30/89	8900561	PERMIT REQUIREMENTS MET
3RD AVE. WEST	W008	05/30/89	8900563	PERMIT REQUIREMENTS MET
DEXTER AVENUE	W009	05/30/89	8900565	PERMIT REQUIREMENTS MET

APPENDIX C (Continued)

MONTLAKE	W014	05/30/89	8900564	PERMIT REQUIREMENTS MET
EIGHTH AVENUE	W040	05/23/90	9006690	PERMIT REQUIREMENTS MET
BRANDON ST.	W041	05/23/90	9006687	PERMIT REQUIREMENTS MET
S.W.MICHIGAN	W042	05/23/90	9006691	PERMIT REQUIREMENTS MET
NORFOLK STREET	W044	05/23/90	9006688	PERMIT REQUIREMENTS MET

APPENDIX D

QA/QC Procedures for Metro's Trace Organics Analyses

Metro's Trace Organics QA/QC consists of reagent water blank, duplicate matrix spikes, and surrogates. Reagent water blanks are run to ensure that laboratory contaminants or artifacts are not reported for the samples. A matrix spike consists of an actual sample spiked with a representative group of the compounds being analyzed for by the various procedures. By running the matrix spike in duplicate, variability is monitored and a relative percent difference (RPD) is calculated in addition to the percent recovery of the spikes.

Surrogate spikes are compounds that are added to every sample prior to extraction. After analysis, the percent recovery of the surrogates are calculated and this data is used to monitor extraction efficiency. The surrogates are compounds not generally found in environmental samples and are often isotopically labelled analogs of the compounds of analysis for GC/MS work. These compounds would be expected to behave similarly to the analytes but do not interfere with analysis.

For extractable samples consisting of base/neutral/acids (BNAs) and pesticides/PCBs a minimum of ten percent QC is run. For every ten extractions, blank and duplicate matrix spikes are analyzed in addition to the surrogate. More than ten percent QC is frequently run as often there are not ten samples to run at a time. A set is done for every group of extractions. For volatile organics, surrogates are added to every sample, daily reagent water blanks are analyzed, and duplicate matrix spikes are run for every fifteen analyses. Fewer duplicate matrix spikes are run for volatiles as there is less variability than for extractables.

EPA Methods 608, 624, and 625 recommend five percent QC. While Metro's QC is consistent with these methods, it goes beyond EPA requirements by performing more than the prescribed amount of QC and is more similar to that recommended by the EPA Contract Laboratory Program (CLP). Metro also routinely performs various tasks to ensure that instruments are functioning and calibrated properly. A three- to five- point curve is initially run to calibrate instruments and daily standards are analyzed. The GC/MS systems are tuned to EPA specifications for DFTPP for BNAs and BFB for volatiles and the tune is checked on a daily basis.